Ecological Niche Modeling and Field Surveys for the Kisatchie Painted Crayfish, *Orconectes maleate* – USFWS SWG Contract #447170

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CONSERVATION TARGETS

Scientific Name	Common Name	G Rank	S Rank	State Status	Federal Status
Orconectes maletae	Kisatchie Painted Crayfish	G2	S2		

INTRODUCTION

The Kisatchie Painted Crayfish has few historic records and is endemic to northeast Texas and western Louisiana. Most specimens have been collected in the Kisatchie Bayou drainage in Louisiana and the Cypress Creek drainage in Texas (Walls 1985). This species has historically been collected both in small, sandy streams and large, silty rivers. Little is known about the habitat requirements of this species. A thorough literature review turned up no peer-reviewed publication on the ecology or population genetics of this species.

The objectives of this study were to: 1) Visit all historical collection localities to determine if the range of the species has been reduced, 2) Create an ecological niche model using distribution data to determine the potential distribution of the Kisatchie Painted Crayfish in Texas, 3) Quantify the environmental variables that are part of the species' ecological niche in Texas, and 4) Provide a new management tool in the form of an ecological niche model that can be refined with additional occurrence points and environmental variables. After we began the study, and recruited a graduate student (L. Brown), we added a population genetics objective to the project. This final objective is to examine genetic variation in the species across its range, with emphasis on a comparison of Texas and Louisiana populations. The distribution of the species in Texas and Louisiana is disjunct, although there may have been historical connection through Caddo Lake.

MATERIALS AND METHODS

Historical collecting localities were obtained from Texas Parks and Wildlife Department. In summer 2014, we visited all of the historical sites and sampled them for Kisatchie painted crayfish. Initially, we used a combination of baited (hot dogs and sardines) minnow traps, electrofishing, and sweeping with a D-frame kick net. Kick nets were determined to be the most efficient collecting method. All of the collections occurred in the Cypress Creek/Caddo Lake drainage. Tissue samples were taken from each specimen for DNA analysis.

These data were geo-referenced and used to develop the ecological niche model. We collected spatially explicit environmental layers (e.g., soils, land cover, drainage area, precipitation, annual flow, etc.), converted all vector files to raster format, reprojected the layers to NAD 1983 UTM Zone 15 N projection, and reclassified each pixel to 100 x 100 m grid size cells.

Ecological niche modeling was conducted using the MAXENT software package. MAXENT produces a predictive model, which can be displayed geospatially, that represents the relative probability of a species occurring in a particular cell, given a set of environmental conditions associated with that cell and known species distributions (Pineda and Lobo 2009, Urbina-Cardona and Flores-Villela 2010). Ecological niche modeling has been used to model spread of invasive species (Thuiller et al. 2005), impacts of climate change (Thomas et al. 2004), and spatial patterns of diversity (Graham et al. 2006). Recent evaluations have shown MAXENT to be a robust method for modeling geographic distributions of species, especially with conservation implications (Phillips and Dudik 2008).

RESULTS AND DISCUSSION

Of the 25 historical collecting localities, fourteen of them had no captures of Kisatchie painted crayfish. One site was inaccessible, and ten sites contained the species. Thus, our survey work suggests that the species is currently found in 40% of its historical collecting localities (Figure 1, Table 1). The Kisatchie painted crayfish seems to be associated with vegetation and detritus along stream margins in the Cypress creek drainage (See Figure 2 for example). No specimens were found in collections downstream of Jefferson, TX.

The top four geospatial environmental data layers for the Kisatchie painted crayfish were landcover, soils, stream order, and drainage area (30.6, 24.2, 16.2, and 9% contribution, respectively). The average test AUC for the replicate runs was 0.833 (0.069 SD). The results of the jackknife test of variable importance showed that the variable with the highest gain, when used in isolation, is soils. Therefore, soils appears to be the most useful predictor of habitat suitability. Likewise, the environmental variable that decreased gain the most when omitted was landcover. Thus, landcover has the most information that is not present in the other environmental data layers (See Figures 3 and 4; higher resolution Maxent maps are available upon request).

In summary, we feel the Kisatchie painted crayfish has exhibited significant declines in its geographic range in East Texas. We therefore recommend this species be afforded protection and conservation action. Future work by our research team will include: 1) sampling in Louisiana to determine the conservation status across its entire range, 2) sampling of additional sites in East Texas to ground truth our ecological niche model and verify its prediction accuracy, and 3) DNA analysis to determine genetic diversity within the disjunct populations in East Texas and Louisiana. The graduate students (J. Hernandez and L. Brown) working on this project are slated to graduate in Spring 2015 and 2016, respectively. Their theses will be important and necessary to make decisions about how to accurately classify the species in terms of conservation status and also provide information on habitat use that will be necessary for the development of critical habitat and species conservation plans.

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Table 1. Location of collections for the Kisatchie painted crayfish – Summer 2014.

Site Number	County	Latitude	Longitude	Date Collected	Tissue Sample Name
1	Upshur	32.77541	-94.94578	6/12/14	OM1, OM2
2	Upshur	32.79811	-95.04985	6/12/14	OM3, OM4
3	Upshur	32.79075	-95.09458	6/12/14	None Collected
4	Upshur	32.70313	-94.80828	7/4/14	None Collected
5	Gregg	32.67281	-94.75155	7/4/14	OM5
6	Harrison	32.63586	-94.67286	7/4/14	OM6
7	Harrison	32.62358	-94.57773	7/4/14	None Collected
8	Harrison	32.62743	-94.51598	7/19/14	None Collected
9	Harrison	32.67161	-94.42331	7/19/14	None Collected
10	Marion	32.79878	-94.5897	7/19/14	None Collected
11	Marion	32.78889	-94.51634	7/28/14	OM18
12	Marion	32.78569	-94.51417	7/19/14	None Collected
13	Marion	32.7497	-94.49978	7/25/2014, 7/28/14	OM7-OM13, OM14-OM17
14	Marion	32.84863	-94.43212	7/28/14	None Collected
15	Cass	32.89255	-94.44119	7/25/14	Private Property
16	Marion	32.75633	-94.34306	8/2/14	OM19-OM20
17	Marion	32.73613	-94.28851	8/6/14	None Collected
18	Harrison	32.69605	-94.18785	8/6/14	None Collected
19	Titus	33.02177	-94.88128	8/8/2014, 8/13/14	OM21-39, OM45-50
20	Titus	33.07185	-94.96546	8/8/14	OM40-44
21	Titus	33.09425	-95.01338	8/8/14	None Collected
22	Titus	33.04824	-95.09604	8/13/14	None Collected
23	Franklin	33.0511	-95.14247	8/13/14	OM51
24	Franklin	33.05247	-95.2206	8/13/14	None Collected
25	Franklin	33.02401	-95.27005	8/13/14	None Collected

Table 2. Geospatial environmental data layers used for ecological niche modeling for the Kisatchie Painted Crayfish.

Layer ID	Layer Description
Landcover2_1	Land Cover
Ssurgo2_1	SSURGO soils
Buf_strmor2_1	Strahler Stream Order
Buf_cdsqkm2_1	Cumulative Drainage Area in km^2
Isotherm_2	Isothermality (Bioclim)
bfi2_1	Base Flow Index
Huc_acc_2_1	Hydrologic unit code (sub-basin level)
Bio17_2_1	Precipitation of driest quarter
Xtempwq8_2	Mean temperature of the wettest quarter
Buf_flow_2	Mean Annual flow
Buf_vel_2	Mean Annual velocity
Precipwq16_2	Precipitation of wettest quarter
Bio_12_2_1	Annual Precipiation
Xtempdq9_3	Mean temperature of driest quarter
Buf_slope2_1	Slope of stream

Figure 1. Historical and current locations for Kisatchie painted crayfish in East Texas.

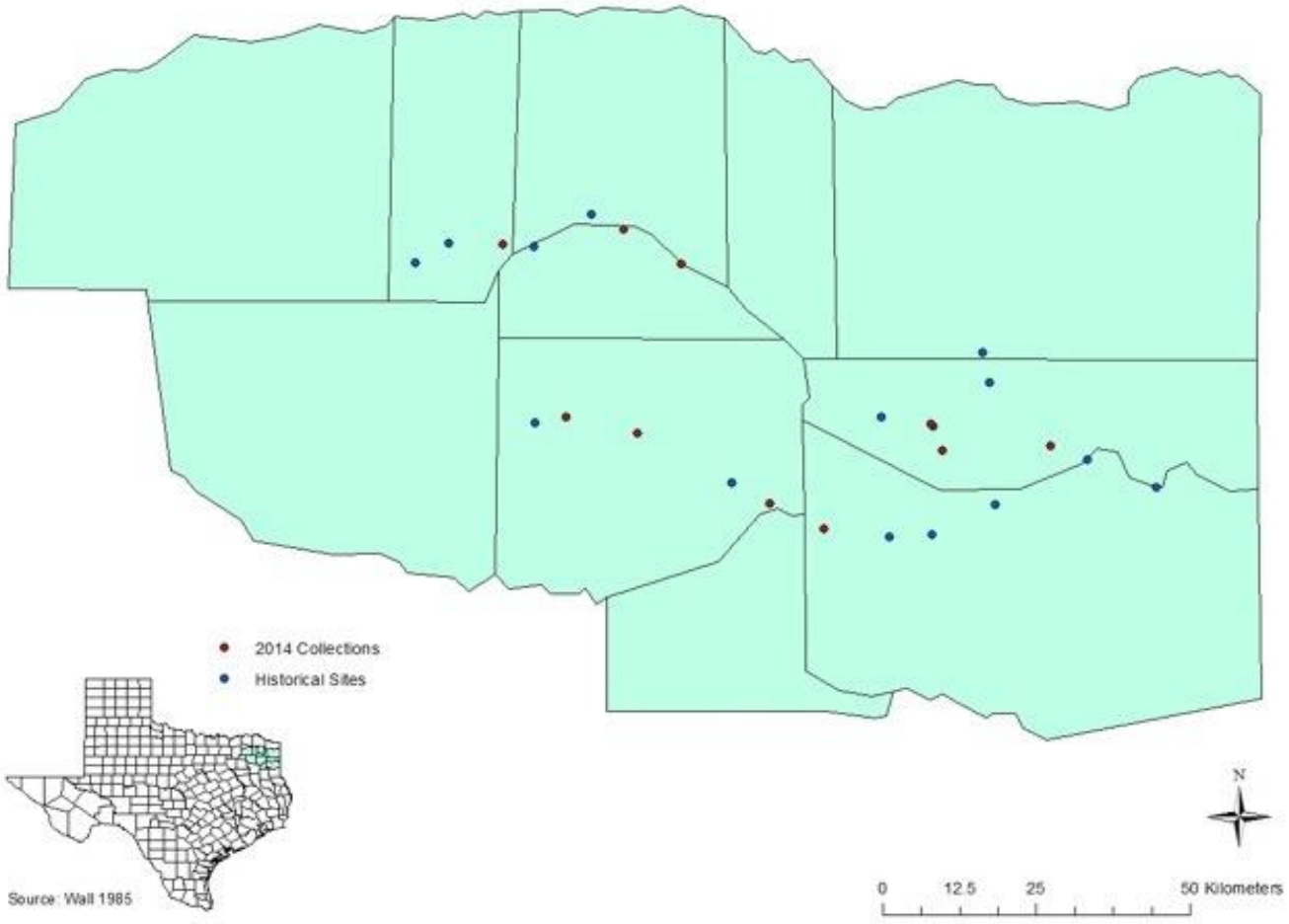

Figure 2. Photograph of a typical collecting site for Kisatchie painted crayfish on Little Cypress Creek (Hwy 59).

Figure 3. Ecological niche model for the Kistachie painted crayfish, *Orconectes maleate,* in the Red River drainage of Texas.

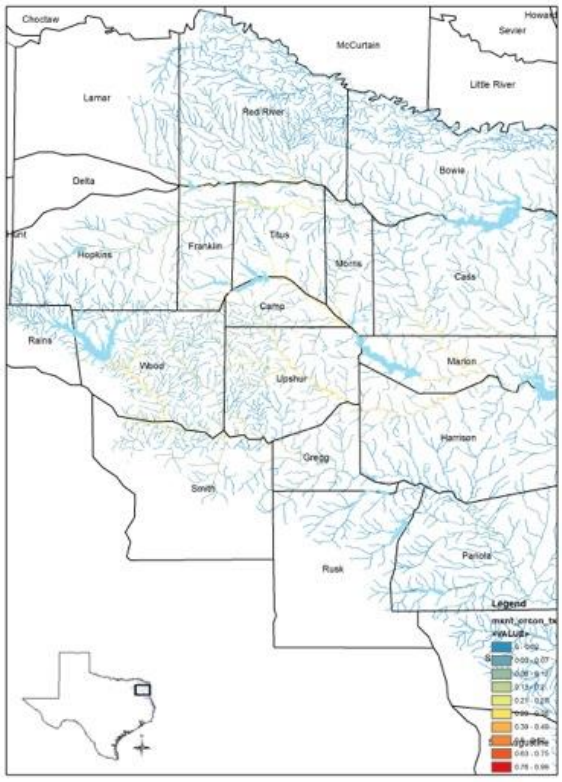

Figure 4. Zoomed in areas of the ecological niche model for the Kisatchie painted crayfish in the Red River drainage of Texas. Areas that are highlighted in warmer colors (red, orange, etc.) are most suitable to this species and where this species is most likely to occur.